DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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1. Arc Welds in Ship Plate

Metallographic investigation is being made of arc welds in ship plate performed by different systems and under different conditions, to determine the cause of the brittleness often associated with such welds. The electrolytic emf difference and corrosion of such welds are also being given consideration, in view of the possibility of enhanced corrosion of welded ship plates of hulls. This work is all carried out in cooperation with the Electric Welding Committee of the Emergency Fleet Corporation.

2. Magnesium-Aluminum Mirrors

The mirror alloy of highest reflecting power ($Al_3 Mg_4$) is very brittle as cast. Experiments involving its remelting in vacuo are being carried out, resulting in great improvement in the strength of this alloy.

3. Airplane Instrument Diaphragms

The behavior of diaphragms used incertain aircraft instruments (aneroid barometers, etc.) is being studied with reference to effects of composition, working, and heat treatment on the elastic lag and "after effect" in their indications, with the object of making such lag as small as possible. Good progress has been made.

4. Platinum Substitutes

Samples of ware of rhotanium (a gold-palladium alloy) have been thoroughly tested as to their resistance to action of chemicals and of heat. This ware compares very favorably in almost all respects with platinum, for general chemical use as for example, in crucibles.

5. Hardware for Army

The preparation of standards for enamels and enamelled ware and general hardware for various items of kitchen and other equipment for the Army is being undertaken in cooperation with the branches of the service involved, and numerous conferences have been held, while necessary experimental work is being initiated.

6. Copper Pressure Cylinders

At the request of the Ordnance Department, U.S.A., and the Association of Manufacturers of Small Arms and Ammunition, the Bureau of Stand-

ards is undertaking an investigation looking to the standardization of copper pressure cylinders for the testing of powder. This will include the preparation of specifications for the copper, defining exactly the amount and method of pre-compression, methods of use, etc.

7. Metallographic Tests.

Metallographic tests -- all for military departments -- included examination of 12 discs from gun forgings to determine uniformity of annealing, two types of steel from motor truck springs, samples of kitchen cutlery and horse-shoe nails with reference to specifications, ingot runners, gun steel to show effect of heat treatment, 12 samples of duriron to show condition before and after malleabilizing , and samples of Browning machine gun barrel extension from each of several manufacturers to show variations due to different heat treatments.

8. New Metallurgical Equipment

The Metallurgical Division has recently completed the installation of a two-high, 16" motor-driven rolling mill of 4:1 speed range, which will take ingots up to 4 inches. This willbe used in the preparation of materials for investigation of aluminum alloys and special steels. A 150-ton forging press is nearly ready for work, as also a half-ton electric melting furnace.

9. Metallurgical Information

Specific information on the following subjects has been furnished the military services by correspondence: standardization of copper compression cylinders; aluminum alloys; firing pins; metal for diaphragms; new steel processes; manganese steel castings; storing steel samples; heat treatment of steel; die casting metal for compass boxes; soldering fluxes; Morris process of liquid forging; zinc-aluminum alloys; conservation of tin; metal strip scrap conservation; digest on aluminum and its light alloys; use of flour for drawing nickel-chromium wire; aluminum solders; re-sharpening of files; tests on Metallic Phosphoro; metal coatings on balloon fabrics.

10. Airplane Structural Development

Upon obtaining the necessary chrome-vanadium steel two variable camber ribs being developed by Mr. H. F. Parker, formerly of the British Air

Service, were made up from designs previously prepared. This work is being carried on in cooperation with the National Advisory Committee for Aeronautics. After heat treatment to obtain the desired resilient properties, loads were applied in increments of one-quarter of the flying load to the normal flying load, causing the change in shape from the streamline to the lifting form. A satisfactory configuration was obtained although not in exact conformity with the ideal curve laid out. Loads were then applied to the limit of carrying capacity of the supporting frame. Sixteen times the flying load was applied without causing complete failure or observable permanent deformation. Annealed chrome-vanadium steel and other alloy steels are under investigation as of possible utility in this type of construction.

11. Welding Apparatus

An extensive investigation is being initiated to determine the relative merits of various makes of oxyacetylene apparatus for welding and cutting purposes in connection with the purchase of large quantities of this apparatus by government agencies.

12. Wood Investigations

Torsion and cross bending tests of rock elm have been made. Experimental data are being accumulated with respect to the treatment of Ceiba wood as an insulating material for refrigerator use.

13. Measurement of Hardness

A table giving the Brinell hardness numerals for each hundredth millimeter diameter of indentation from 2.00 to 6.94 mm and for pressures of 500 to 3000 kg, has been compiled and printed on heavy white paper. The values for every hundredth millimeter save much tedious interpolation so frequently necessary with the ordinary tables having steps of five hundredths millimeter.

Hardness tests were made on motor truck springs and on hammers with steel handles.

Preliminary examination was made of the new Smith hardness testing device which is an ingeniously designed manually operated device for measuring the hardness of material whose form is such as to make it inaccessible to the common types of hardness machines.

14. Design of Field Cots

Examination was made and reports prepared for the Quartermaster Corps on the strength and construction of folding cots for hospital use overseas. A safety lock for the folding legs was designed and the design adopted for use on the cots.

15. Other Strength Tests

A design of vacuum food container was examined and modifications suggested to improve its strength and permanence. An 8 in. Barbette carriage piston rod upon proof load of 920,400 lb. was found satisfactory. Two cast steel truck wheels were tested to destruction by radial compression, failing under loads of 180,500 and 155,000 lb. respectively. Both wheels showed very satisfactory strength. Sixty-two vehicle and harness chains sent from the General Engineer Depot were tested in tension to determine the comparative strengths of different designs of links and hooks and of electric, gas, and forge welds. Six tensile specimens of centrifugal steel castings were tested. Three had been quenched once following heating, and showed a lower yield point and ultimate strength but a greater ductility. Ninety-three impact-shear tests were made on 31 specimens of Cr-Ni Steel giving average results of about 75 ft.lb. for specimens 10 mm square.

16. Transmission Belting

Complete tests of various types of transmission belting as requested by the Office of the Chief of Staff, were carried out in order to obtain data to be used as a basis for specifications on the standardization of transmission belting for use in the field. The types tested comprised oak leather, water-proofed leather, stitched canvas, solid woven cotton, rubber frictioned surface, rubber covered, hair and balata. Tests were made for the transmission of power, effect of heat, and the determination of the stretch and tensile strength.

17. Other Mechanical Leather and Rubber Tests

Sixty-four rolls of leather consisting of sides of harness, strap, latigo, sheepskin, bag, and smoked elk are being tested for both physical and chemical properties to assist in drawing up standard specifications for the War Department. Assistance has been given the standardization committees in drawing up specifications for the

purchase of mechnaical rubber goods. A specification for 1½" and 2½" single and double jacketed hose has been completed. Other tests include solid tires, inner tubes for pneumatic tires, whip lashes, rubber covered wire, rubber sheet packing, and air brake hose.

18. Airplane and Balloon Fabrics

Efforts have been made to improve the existing types of airplane fabrics with a view to increasing their reliability and serviceability and to facilitating large scale production. The chief alteration contemplated consists of increasing the relative strength of the filling as compared to the warp. Samples woven in accordance with the new design are being made and will be subjected to the usual comprehensive laboratory and service tests.

The increased demand for balloon fabrics by the various military agencies has necessitated the development of new designs for these materials. It is hoped that the work being done will lead to the design of a type of fabric permitting of a greatly increased rate of production.

19. Gas Mask Felts

The Bureau has carried on preliminary work on gas mask felts to secure information as to the requirements for high smoke resistances without exceeding the permissible upper limit for the resistance to the passage of air. Samples have been manufactured for test using mixtures of wool of various grades and comprising also admixtures of other materials which seemed promising.

20. Textile Specifications

Specifications for the physical and chemical testing of cotton, woolen, jute and silk textiles have been supplied the office of the Quartermaster General by the Bureau. By this agreement to the standard practices of the Bureau, it is believed that much of the confusion which has previously existed as to methods of test will be done away with.

The Navy has been furnished with specifications regulating the manufacture and testing of pontoon sheeting for hydro-airplanes.

Specifications for automobile radiator and hood covers have been drawn up for the Motor Transport Corps.

Representatives of the Textile Section have acted on the various committees appointed by the General Staff for the standardization of all

textiles purchased by the War Department. Duplicate and unnecessary specifications have been eliminated and where existing specifications were not adequate new ones have been prepared.

At a conference held at this Bureau on September 18, attended by representatives of the Federal Trade Commission, The War Industries Board, The Navy Department, The Bureau of Plant Industry, The Bureau of Standards, and of the largest oakum manufacturers, specifications were drawn up and approved, regulating the grades and specifying the manner of testing oakum.

21. Tank Gun Sights

The range scale for the type of tank gun sight which has been adopted by the Army was calculated, and optical tests were made on recent samples manufactured by Chicago and Boston firms; these were found to be satisfactory. In pursuance of a cable request from the Expeditionary Forces, all the optical constants of a French periscopic alidade were determined and submitted to the Engineer Corps. At the request of the Ordnance Department the curves of the lenses of a 37 mm gun sight were measured, since it was difficult to obtain the information required by inquiry of the manufacturers. The Bureau has been consulted in connection with the tests and specifications for the glass of eye-protective goggles. At the request of the War Industries Board the types of glass used for mil scales of binoculars were investigated with reference to the ease of etching and it was found that the glass regarding which etching results had been the most favorable, was an ordinary crown. For a special use by the Ordnance Department, the Bureau has prepared plain parallel mirrors of plate glass 30" square, the surfaces of which were necessarily of a high order of accuracy. Optical instruments tested during the month of September included 87 field glasses, 360 ship glasses, 3 gun sight telescopes, 8 lenses for goniometer (focal length determinations), and 14 pairs of test plates, all for branches of the military services.

Lieutenant Cretien, a specialist in optics of the Ministére de l'Armement, has recently joined the staff of the Bureau of Standards temporarily through the courtesy of the French Government to cooperate with the experts of this Bureau in the investigation and design of optical systems for military uses.

22. Engineering Instruments

Information was supplied to the Construction Division of the Army with respect to the comparative merits of a number of thermostatic radiator return line valves, of which the Bureau has tested more than 40 different makes. Pressure tests were made on two powder containers and an aluminum gun casting for the Engineering Bureau of the Ordnance Department. A report was made to the Office of the Quartermaster General on an investigation of a fire extinguisher of the carbon tetrachloride type using stored air pressure to deliver the liquid.

23. Aeronatic Instruments

In connection with the design of spinning top inclinometers being considered by the Bureau, construction has been begun upon a top which is to operate in vacuo. Another interesting design which has been developed is one which may be called a breathing top which is operated by vibratory changes in the density of the air around the top. Tests have been made on the Garnier and Hebrard types and an experimental top has been constructed to permit of studying pivot friction.

The accuracy with which bombs can be dropped from airplanes is seriously limited by the rolling of the airplane. To obviate this difficulty a bomb sight has been developed which makes use of the stabilizing properties of the spinning top. A system of bombing has also been devised for use in connection with the stabilized sight which makes use of the compass as a means of correcting the lateral drift due to the wind and for reducing to a minimum the number of operations which the operator must perform.

Rate-of-climb indicators using thin metal, and rubber diaphragms have been constructed and tested with promising results. A Dutch rate-of-climb indicator of the electro-magnetic type is also under investigation.

Statoscopes now in use show large errors due to changes of temperature of the surrounding atmosphere. An investigation of the possibility of overcoming this difficulty has been begun. The use of a vacuum jacketed container with silvered surfaces has been found to reduce the effect greatly. A statistical summary of the results of regular tests of air speed indicators is being

undertaken to determine the average or type errors of the different forms in use. A study has been made of the recovery curves of air speed indicators after overpressure.

With respect to tachometers extensive mathematical studies are being made of various forms of the centrifugal type. Experimental work has been done on the gravitational compensation of the Olhovsky tachometer as well as studies of the elastic properties of tachometer control springs. A type of revolving circular spring centrifugal tachometer has been designed by the aeronautic instruments section and given careful test. A special Van Sicklen tachometer with an automatic stop mechanism and a Leeds and Northrup speed regulator for use on bomb sights were tested. As a result of the extensive investigations of tachometers conducted by the aeronatic instruments section it has been concluded that emphasis should be placed on the development of instruments of the centrifugal type.

An aneroid barometer of American manufacture utilizing a cam and roller multiplying device instead of the sliding contact or chain hitherto commonly employed, has been investigated, and gives promise of satisfaction. Special tests were conducted on aneroid stacks for oxygen control apparatus and on special reducing valves for oxygen apparatus.

A group of Danish instruments submitted by the National Advisory Committee for Aeronautics including barograph, altimeter, compass, fore-and-aft and lateral inclinometers were investigated to determine their properties when compared with other makes.

The Bureau has made for the Bureau of Aircraft Production several standard mercury manometers and has prepared a design (with specifications) of a manometer for instrument testing purposes in a form suitable for production by manufacturers.

Twelve Aeronautic Instrument Circulars have recently been issued, dealing with the following subjects: Historical notes on aneroid barometers; Comparative tests on two aneroid barometers in England, France, Germany, and America; Methods of testing aneroid barometers; Statoscopes; Rate-of-climb indicators; High altitude baro-

graphs; Methods of testing air speed indicators; Airplane pressure gages; Airplane gasoline gages; Inclinometers; Airplane tachometers; and the Jenkins night altitude indicator, and also a list of the Aeronautic Instruments Circulars.

34. Munitions Gage Testing

The net totals of munitions gages tested during the month of September at the Washington, New York, Cleveland, and Bridgeport gage laboratories were as follows: lots received, 408; total number of gages received, 5050; number of thread gages, 3313; number of profile gages, 394; number of plain gages, 2644. The average length of time lots were in the Bureau amounted to about five days. Of the gages submitted during the month 3473 have been stored after inspection awai ting shipping instructions from the Ordnance Department and Motor Transport Corps. Seventy-one gages were salvaged while eighty-two are in process of modification. Thirteen new gages were manufactured, while 356 are in progress. The first class in gage instruction completed its work and the second class, which has recently opened includes 14 members representing about a dozen district ordnance offices.

35. Investigation of Concrete Hardeners

A number of concrete floor slabs in the corridor of one of the buildings at the Bureau have been treated with various commercial floor hardeners to obtain a comparison between the effect of these treatments under actual use. Some of the slabs were left untreated in order to obtain a comparison between the treated and untreated surfaces. Some of the concrete floors in this building have been treated with linseed oil and one with a patented wax treatment. The latter treatment so far appears to be very effective in preventing dusting and excessive wear.

Floor slab specimens have been made and treated with various commercial hardeners for comparative abrasion tests. A new abrasion apparatus is in process of construction for the purpose of making comparative wear tests on various flooring materials. This apparatus is expected to give an abrading action very similar and comparable to that of floors under the actual conditions of use.

26. Effect of Oil on Concrete Tanks

Supplementing a general field investigation made in 1917 to determine the effect of oil on concrete tanks used for storing oils, laboratory tests are under way. Twenty-five tanks, capacity 10 gallons, of 1:2/3:1-1/3 concrete, sand graded from 0 to $\frac{1}{4}$-inch and gravel $\frac{1}{4}$ to $\frac{1}{2}$-inch were fabricated. These tanks will be put under test upon completion of gauges for measuring the oil. Six tanks of the same proportions as above will be tested under a head of 25 feet of oil this coming month. Tests are to be made on 1:2:4 tanks under conditions that will enable a more accurate control of the losses due to evaporation and temperature changes. This will give more reliable data relative to the penetration of the oils than were obtained in the first series of tests.

27. Effect of Reversal of Stresse escon Concrete

This investigation was undertaken for the Shipping Board in order to obatin data under conditions comparable with the stresses undergone by a ship at sea. One unit of a machine for carrying on this test is in operation; the other two have been calibrated and the beam will be put under test in them during the coming month. The beam undergoing test in the first unit has undergone 800,000 reversals under a load of 5,000 pounds. Numerous cracks on one flange of the beam are developing a grinding action which is causing the concrete along the edges of the cracks to flake off.

28. Light Aggregates for Concrete

Experiments have been continued in the search for the best materials to be used for aggregates in producing light weight concrete. The most promising material obtained so far is a burnt clay aggregate giving a density of approximately 100 lbs. per cubic foot and a strength about equal to that of a good sand and gravel mix.

29. Addition of Kieselguhr to Mortar and Concrete

An investigation is being carried on on the effect of the replacement of a part of the Portland cement in mortar and concrete by finely ground kieselguhr. This material has been offered as improving the working qualities of the product, and experiments are being made to determine its effect on the strength, permeability, absorption and plasticity in 5, 10 and 20% substitutions.

30. Cement Gun Products

Determinations are being made of the value of concrete fabricated with the cement gun and of the effect of concrete so placed in a number of different operations, including the study of the effects of different mixtures and of different methods of operating the machine. Comparisions are being made with parallel tests of the same materials fabricated by the ordinary methods.

31. Concrete Mixing Experiments

In studying the effects of different methods of mixing concrete, that of adding water to the cement and running the mixer a certain period before adding the sand and gravel was found to offer no advantage over the usual process.

Construction work has been started on a series of concrete tanks near the Potomac River as a part of a program previously outlined to ascertain the necessity of waterproofing concrete made by the approved methods and to determine the value of commercial waterproofing compounds.

32. Paper Mold for Concrete Specimen

A few tests have been made to determine the suitability of paper molds for making concrete test specimens. The iron molds previously used for this purpose are heavy and inconvenient to ship when it is necessary to make the specimens outside of the laboratory. The tests indicate that good specimens may be obtained by using cylindrical paper molds with a cap on the lower end, providing the molds are dipped in paraffin to prevent absorption of water from the green concrete.

33. Routine Cement Testing

During the month of August, 1,047,423 barrels of tested cement were shipped under supervision of inspectors at the Bureau. A branch chemical laboratory will be established at Northampton, Pa. The new laboratory in Hudson, New York, which started operation August 1st, supervised the shipping of over 196,000 barrels of cement during the month of August. During the same month, 68,787 barrels of cement were rejected as failing to meet the government specification requirements.

Respectfully,

S. W. STRATTON

Director